Predatory Behavior of the Spider Wasp, *Chalybion californicum*

(Hymenoptera: Sphecidae)

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Chalybion californicum (Saussure) (= *caeruleum* of authors) is a common steel-blue mud-daubing spider wasp found throughout most of North America from southern Canada into Mexico (Bohart and Menke, 1963). Its nesting biology has been studied by Rau (1928a, 1928b), but only a few isolated observations of its predatory behavior have been reported. The Peckhams (1898) observed a species of *Chalybion* preying on *Araneus cornutus* Clerck (= *Epiera strix*). The wasps crawled into cracks and corners of cottage walls and dislodged the spiders. They captured spiders with their mandibles and forelegs and stung them at that time or after taking flight. Rau (1928a) observed a *C. californicum* attempting to capture a *Lycosa* spider by landing on its back. Howard (1922) reported that Schwarz (presumably Herbert F. Schwarz) observed *C. californicum* entangling itself in webs and causing spiders to run out of their retreats. The wasps would then free themselves and pursue the spiders. Frost (1944) reported this species engaged in the same behavior.

Observations reported here were made on eight days from June 27 to July 17, 1974, on the campus of the University of California, Berkeley, and confirm the pattern in the accounts of Howard (1922) and Frost (1944). *C. californicum* females employ an efficient form of aggressive mimicry in capturing their prey. This activity took place on one *Garrya elliptica* Dougl. bush harboring a large population of immature *Zygiella x-notata* (Clerck), an araneid spider. *Z. x-notata* constructed orb webs that usually had one of the dorsal pie-slice shaped sectors missing. From the center of each orb web a strong signal line ran to a tubular retreat, usually above the orb. The leaves of *G. elliptica* are oblong with the lateral edges curled under. The sheltered undersides of the leaves provided suitable retreats for *Z. x-notata*, and openings in the foliage provided many locations for their webs. During the day, the spiders remained in their retreats and used their front legs to monitor the signal line for vibrations transmitted from the orb. *Chaly-*

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FIG. 1. *Chalybion californicum* female pulling and vibrating the web of an immature *Zygiella x-notata*.

bion females were about four or five times as large as *Zygiella*. In approximately eleven hours of observations at least three individual wasps vibrated webs more than a hundred times and captured more than twenty spiders.

In a typical sequence a *Chalybion* female flew into openings in the

foliage where she then slowly flew into the exposed face of an orb web and alighted. After remaining motionless for a few seconds, she began pulling on the web with her legs (Fig. 1), mimicking an entangled insect. After several seconds of pulling and vibrating a web, she took flight and repeated the performance on the next orb she encountered. This continued until a spider, responding to the vibrations of its web, ran down the opposite side of the orb from the wasp. Just as a spider was about to reach her, the wasp lunged forward, seized the spider with her mandibles and forelegs, curled her abdomen up underneath her body and stung the spider for several seconds. The exact placement of the sting could not be observed. One spider avoided capture by dropping off the web just as a wasp lunged for it, and the wasp did not pursue it. None of the wasps became entangled in a web.

After a wasp stung a spider, she presumably transferred it to the other side of the web, but this could not be observed. She then carried it across the web to a leaf or stem and then manipulated and rolled the spider with her forelegs and mandibles, in the manner described by the Peckhams (1898). Occasionally a spider was stung again after manipulation. One wasp was disturbed while manipulating a spider. She flew to another leaf and started manipulating the spider again but then dropped it, apparently by accident. Rather than trying to find the spider, she groomed herself for a few seconds and then flew to two more orbs before flying away.

Wasps frequently interrupted their hunting and landed on leaves to groom themselves, and sometimes they walked over the leaves and stems. Twice wasps walked to the lower edge of an orb and used their forelegs to vibrate the web. One spider responded to these vibrations and was captured by the wasp. Several times wasps walked on leaves that had spider retreats underneath. They often crawled around the side of such a leaf, as if examining the retreat, but none attempted capture of spiders in their retreats.

About half the spiders did not respond to the vibrations of their webs. A smaller proportion left their retreats but then returned before approaching the wasp. One spider with a relatively exposed web near the top of the bush repeated this sequence three times in response to one wasp. Spiders were never pursued. They were captured only if they ran to the wasp. The wasps were unable to perceive whether a web contained a spider because they often visited vacant webs.

When attempting to alight on the webs the wasps flew slowly with their legs outstretched and hanging below their bodies. In this position the tarsi were oriented approximately perpendicular to the direction of

flight and anterior to the body and wings, enabling contact of the web by the tarsi, rather than the body or wings. After alighting, wasps used their tarsal claws to hang onto and pull the webs (Fig. 1). Other contact points may be the arolia and the ventral surface of the tarsal segments.

Muma and Jeffers (1945) found that Theridiidae and not Araneidae were the most common prey of *C. californicum*. They concluded that the species of spider preyed upon depends on where the wasp hunts. This is usually on or near the ground and around human habitation, the haunts of most theridiids, but in several cases they found that the wasps only collected foliage inhibiting spiders. This suggested that once a wasp captured a spider, it returned to the same area on subsequent trips. In the observations reported here two female wasps were marked with a nontoxic paint at the *Garrya* bush, but only one of them was seen again, when it returned the following day and captured a spider.

This bimodal distribution of prey type suggests flexibility in predatory behavior of *C. californicum* because there are important biological differences between many theridiids and araneids (Bristowe, 1971). Most theridiid webs are 3-dimensional mazes; most araneid webs are 2-dimensional orbs. When araneids subdue their prey, they usually run to the entangled insect and immediately bite it or wrap it first in silk. Many theridiids often keep their distance and cast silk threads over their prey. Only after the insect is covered with silk and immobilized, do they approach to bite it. Recalling the observations of the Peckhams (1898) and Rau (1928a), it may be that *C. californicum* becomes conditioned to certain prey species and this is reflected in variations in its predatory behavior.

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